

**“COMPARISON OF ONSET TIME AND
INTUBATING CONDITIONS ACHIEVED WITH
SUCCINYLCHOLINE 1.5mg/kg AND
ROCURONIUM 0.6mg/kg & 0.9mg/kg IV”**

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CONTENTS

SL.NO.	TITLE	PAGE NO.
1.	INTRODUCTION	1
2.	AIM OF THE STUDY	2
3.	PHARMACOLOGY	3
	i) SUCCINYLCHOLINE CHLORIDE	
	ii) ROCURONIUM BROMIDE	
4.	MONITORING NEUROMUSCULAR TRANSMISSION	14
5.	REVIEW OF LITERATURE	22
6.	MATERIALS AND METHODS	34
7.	OBSERVATION AND RESULTS	40
8.	DISCUSSION	52
9.	SUMMARY	58
10.	CONCLUSION	59
11.	ANNEXURES	
	i) PROFORMA	
	ii) MASTER CHART	
12.	BIBLIOGRAPHY	

1. INTRODUCTION

Neuromuscular blocking agents are commonly used to facilitate tracheal intubation.

A perfect setting for tracheal intubation include a rapid onset, profound paralysis of all muscles and short duration of action so that the patients own respiratory function can be restored should intubation prove to be impossible.

These requirements are best met by succinylcholine, an ultrashort acting depolarizing muscle relaxant. However its many unwanted side effects have necessitated a search for an alternative drug or technique to facilitate tracheal intubation.

The introduction of each new muscle relaxant has advanced anaesthetic practice by trying to meet some perceived deficiency in the existing therapeutic armamentarium.

Rocuronium bromide is a steroid, non-depolarizing neuromuscular blocking agent with a rapid onset and an intermediate duration of action. It may be a suitable alternative to succinylcholine.

2. AIM OF STUDY

To study and compare the efficacy of rocuronium bromide in two dosage schedules – 0.6mg / kg (2 x ED₉₅) and 0.9mg / kg (3 x ED₉₅) IV, with succinylcholine chloride 1.5mg / kg IV in patients with respect to:

1. Intubating conditions at one minute
2. Onset of action
3. Adverse effects

3. PHARMACOLOGY

(i) SUCCINYLBCHOLINE CHLORIDE

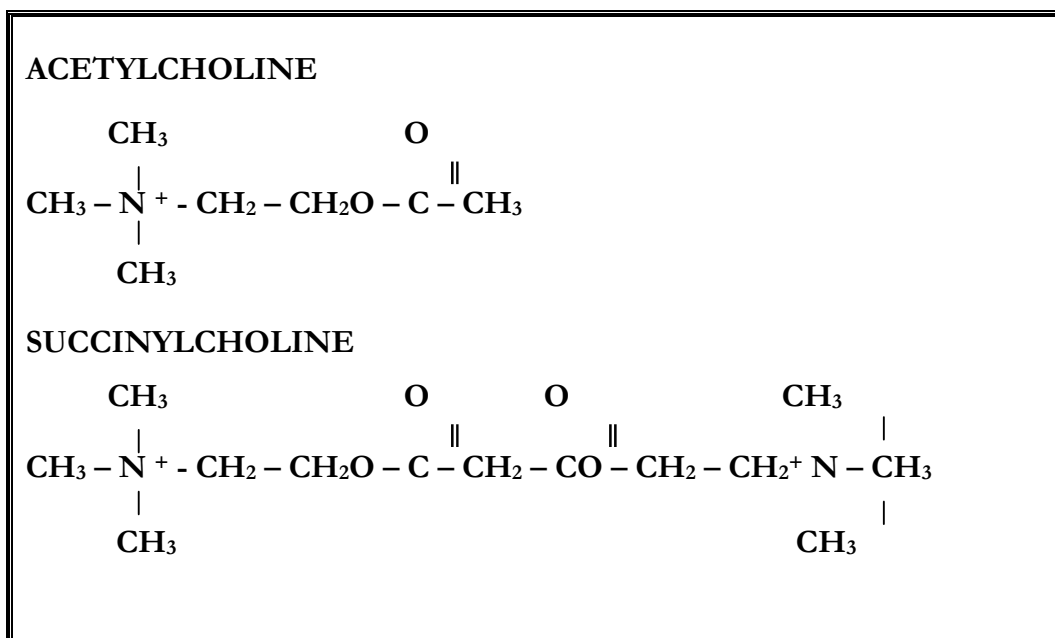
History

Prepared in 1906 by Reid Hunt and Taveau of Boston. Its neuromuscular blocking effects are described in 1948 by Bovet and his colleagues and J.C. Castillo and Edwin de Beer. It was introduced in to anaesthetic practice by Thesleff (1951) and Foldes *et al* (1952).

Chemistry

It is the dicholine ester of succinic acid (equivalent to two molecules of acetylcholine joined back to back)

Molecular Structure



Routes of administration : Intravenous, intra-muscular

Dose :	ED ₉₅	Adult	290 µg/kg
		Children	352 µg/kg
		Infants	608 µg/kg
		Neonates	517 µg/kg

For tracheal intubation 1.0 to 2.0 mg/kg

Onset of action : 30 to 60 seconds

Duration of action : 3 to 6 minutes

Pharmacokinetics:

Metabolism :

98 to 99% of Succinylcholine is hydrolyzed in the plasma by pseudocholinesterase. The metabolites are succinylmonocholine, succinic acid and choline. The neuromuscular blockade produced by succinylcholine is terminated by its diffusion away from the neuromuscular junction back into the circulation. Pseudocholinesterase influences the onset and duration of succinylcholine by controlling the rate at which the drug is hydrolyzed before and after it reaches the neuromuscular junction.

Excretion

Less than 2% of an administered dose is excreted unchanged in the urine.

In vivo hydrolysis rate : 3 – 7 mg/ml/minute

Half-life : 2.7 – 4.6 minutes

Pharmacodynamics

Neuromuscular Junction

Succinylcholine initially mimics the action of acetylcholine at the nicotinic cholinergic receptors (binds to the two alpha subunits) in the post-junctional membrane causing muscle contraction followed by relaxation. Depolarizing blockade (phase I block) is characterized by

- a. Muscle fasciculations preceding the onset of block,
- b. Depression of twitch height,
- c. Absence of fade with train-of-four (TOF) or tetanic stimulation,
- d. TOF ratio > 0.7,
- e. Absence of post-tetanic facilitation and
- f. Potentiation of block by anticholinesterases,

Cardiovascular system

Succinylcholine stimulates all cholinergic autonomic receptors. Nicotinic receptors on both sympathetic and parasympathetic ganglia and muscarinic receptors in the sinus node of the heart are stimulated. In low doses, both negative inotropic and chronotropic responses may occur. These can be attenuated by prior administration of atropine. This generalized autonomic stimulation may result in cardiac arrhythmias.

Side Effects

1. Cardiac arrhythmias: Sinus bradycardia, nodal (junctional) rhythms, ventricular arrhythmias.
2. Fasciculations – uncoordinated muscle twitching. Infrequent in infants and children.
3. Post-anaesthetic myalgias.
4. Hyperkalemia: Serum potassium transiently increases by 0.2 to 0.5 mmol/L in normal individuals. This effect is exaggerated in burns patients (24 hours to 2 years), post-trauma (7 days to 60 days) and in patients with neuromuscular disease or nerve damage (within 6 months).
5. Increased intra-ocular pressure.

6. Increased intra-cranial pressure.
7. Increased intragastric pressure.
8. Salivation and gastric secretions are increased.
9. Allergic reactions.
10. Association with masticatory muscle stiffness, masseter spasm and malignant hyperthermia.
11. Prolonged apnoea – **SCOLINE APNOEA** with abnormal pseudocholinesterase which is genetically determined in certain community, or an acquired deficiency of pseudocholinesterase as pregnancy, malnutrition and liver disease.
12. **Phase II block** – Prolonged administration or large doses of succinylcholine produces a blockade which has non-depolarizing characteristics.

Contra-indications to the use of succinylcholine

Succinylcholine is strictly contraindicated in certain disease states:

1. Patients who have a family history or known susceptibility to malignant hyperthermia. In these patients, succinylcholine may cause rhabdomyolysis, hyperkalemia and cardiac asystole.

2. Muscular dystrophies
3. Myotonia.
4. Post-burns (24 hrs to 2 years).
5. Neurologic disease (eg. Paraplegia, stroke) (within 6 months).
6. Post-crush injuries (7 to 60 days)
7. History of prolonged apnoea in previous surgeries.

Presentation

As a clear aqueous solution containing 50mg/ml of succinylcholine chloride. It is also available as powdered form.

Cost

Rs.31/500 mg

(ii) ROCURONIUM BROMIDE

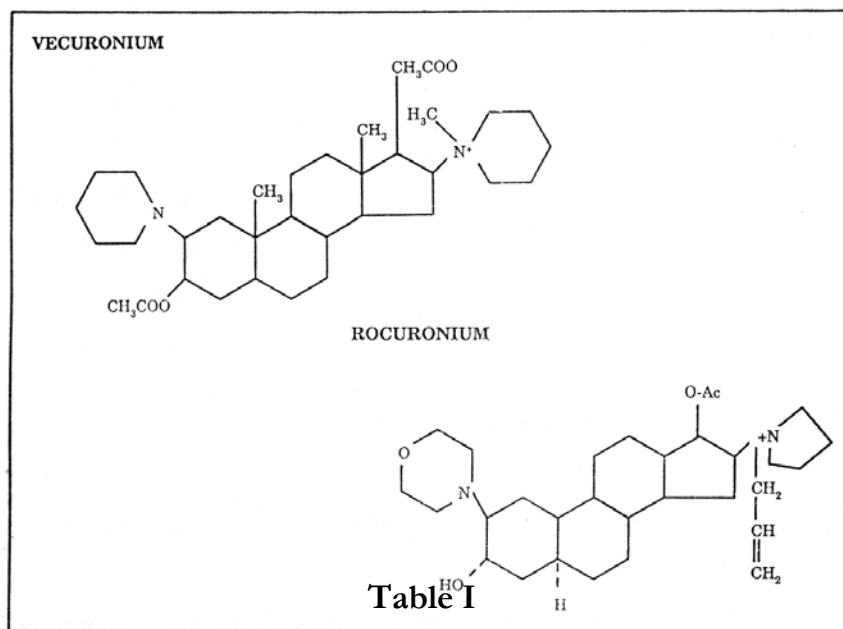
Originally synthesized and studied in the Organon Teknika Laboratories as ORG 9426. Introduced into clinical practice in 1994.

Chemistry

Rocuronium is a steroidal muscle relaxant of intermediate duration. It is the 2-morpholino, 3-hydroxy, 16-N-allyl-pyrrolidino derivative of vecuronium.

1-[(2 β , 3 α , 5 α , 16 β , 17 β)-17-(acetyloxy) - 3 - hydroxy - 2 - (4-morpholinyl)-androst-1-en-1-yl]-1-(2-propenyl) pyrrolidinium bromide.

Molecular Structure



PHARMACOKINETICS OF ROCURIUM BROMIDE

Age group	Volume of distribution at steady state (VD _{ss}) (ml/kg)	Clearance ml/kg/min	Elimination half-life
Normal Adult	207	2.89 ± 0.25	70.9 ± 4.7
Elderly	399 ± 122	3.67 ± 1	08 ± 69.1
Children	224	2.67	46 to 55

Pharmacodynamics

Neuromuscular Junction

It produces non-depolarizing muscle paralysis by competitive antagonism of acetylcholine at nicotinic receptors in the post-synaptic membrane of the neuromuscular junction. It also has some pre-junctional action. Non-depolarizing blockade is characterized by

- a. Depression of twitch height,
- b. Fade with train-of-four or tetanic stimulation
- c. TOF ratio < 0.7 ,
- d. Post-tetanic facilitation, and
- e. Antagonism of block by anticholinesterases.

It is 7 to 8 times less potent than Vecuronium but has a faster onset. Paralysis occurs first in the well-perfused fast muscles and last in the diaphragm. Onset of block is faster but less intense at the adductor muscles of the larynx than at the adductor pollicis muscle, while the diaphragm is affected later but recovers earlier than the adductor pollicis muscle.

The action of Rocuronium can be increased by the presence of hypokalemia, hypermagnesemia, hypocalcemia, hypoproteinemia, dehydration, acidosis, hypercapnia and cachexia. Under hypothermic conditions the neuromuscular blocking effect of Rocuronium is increased and the duration prolonged.

Cardiovascular system

The autonomic safety ratio for vagal block (3.0 to 5.0) is about 10 times less than that of Vecuronium. Reports of slight to moderate increases in heart rate may be due either to Rocuronium producing pain on injection or to its weak vagolytic effect. The heart rate increase may be controlled by the prior administration of fentanyl. Rocuronium in doses upto 0.6 mg/kg has cardiovascular effects that are negligible. At higher doses (0.9 to 1.2 mg/kg) increases in heart rate of 10 to 25% have been observed.

Histamine releasing property

Rocuronium is not associated with clinical signs of histamine release in doses upto 5 x ED₉₅.

Anaphylaxis / Anaphylactoid reactions

In terms of allergy, Rocuronium appears to have a good safety profile.

Central nervous system

No effect as it does not cross the blood-brain barrier. Intracranial pressure is not increased.

Intraocular pressure

Minimal changes in intraocular pressure. Appears to be safe for use in rapid-sequence induction of anaesthesia for perforating eye injuries.

Placental transfer

Rocuronium does not cross the placenta in significant amounts.

Pseudocholinesterase inhibition

This may result in the prolongation of action of drugs dependent on cholinesterases for their metabolism like succinylcholine and mivacurium. The antipseudocholinesterase activity of Rocuronium is less than that of Vecuronium.

Presentation

As a clear colourless solution containing 10mg/ml of Rocuronium bromide. The drug is available in 5 and 10 ml ampoules/vials.

Cost

Rs.330/50 mg.

4. MONITORING NEUROMUSCULAR TRANSMISSION

Neuromuscular transmission monitoring is the continuous measurement of the effect of muscle relaxants on the neuromuscular junction in the muscles.

Importance

The monitoring of neuromuscular function during and after an anaesthetic provides valuable clinical information.

1. At induction, it indicates when good intubating conditions are achieved.
2. During the course of surgery, it indicates the degree of muscle relaxation.
3. At the end of anaesthesia, it indicates adequacy and appropriate time of reversal.
4. It permits appropriate titration of the dose of muscle relaxant to the degree necessary for performing surgery.

It is useful in the intensive care unit to avoid overdosage, residual recurarization or tachyphylaxis.

Principles of peripheral nerve stimulation

Neuromuscular function is monitored by evaluating the response of a muscle to supramaximal electrical stimulation of a peripheral motor nerve.

1. A supramaximal stimulus is 20 to 25% above that necessary for a maximal response.
2. The character of the waveform produced by the electrical impulse should be monophasic and rectangular.
3. The optimal pulse duration is 0.2 to 0.3 ms.

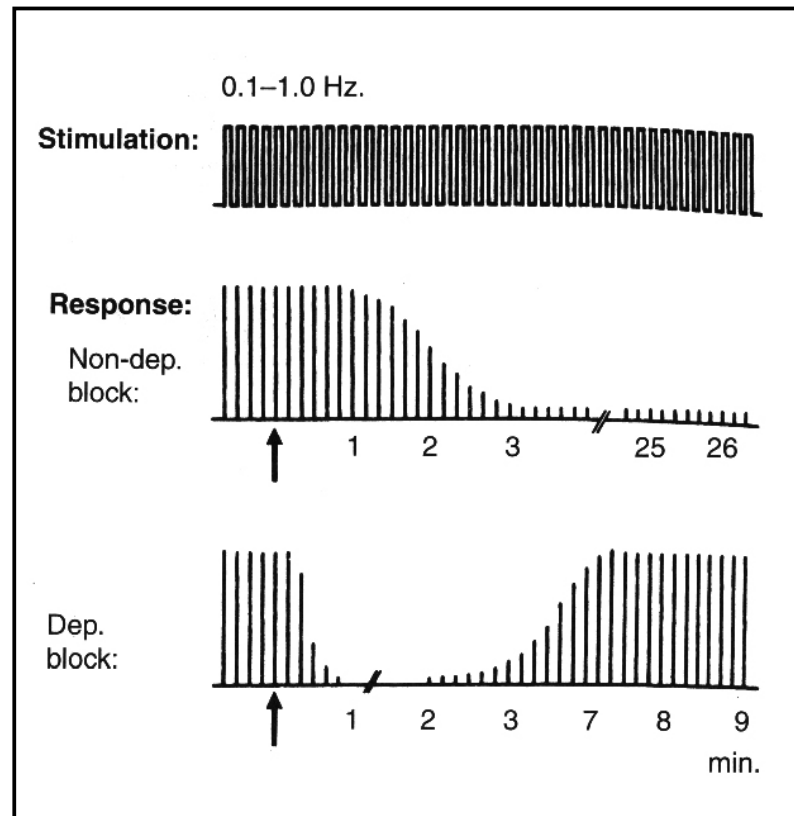
After administration of a neuromuscular blocking drug, the response of the muscle decreases in parallel with the number of fibres blocked, reflecting the degree of neuromuscular blockade.

Patterns of nerve stimulation

1. Single-twitch stimulation
2. Train-of-four (TOF) stimulation
3. Tetanic stimulation
4. Post-tetanic count (PTC)
5. Double burst stimulation (DBS)

1. SINGLE-TWITCH STIMULATION (ST)

A single supramaximal stimulus lasting 0.2 msec is applied to a peripheral nerve at a frequency ranging from 1.0 Hz to 0.1 Hz.

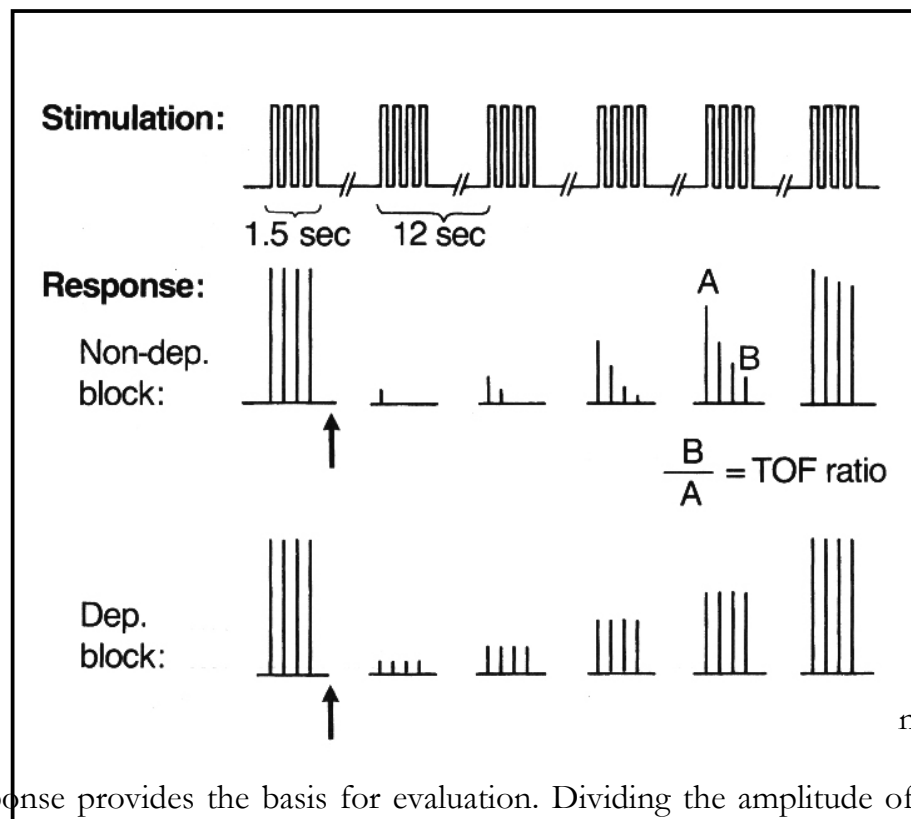


A control twitch height is established prior to administration of muscle relaxant so that the degree of blockade can be assessed by comparing the percentage of twitch height to that of control.

The single twitch is useful in assessing onset, degree of blockade and the recovery time.

2. TRAIN-OF-FOUR STIMULATION (TOF)

Introduced by Ali *et al*, during the early 1970s, four supramaximal stimuli are given every 0.5 second (2Hz).



response provides the basis for evaluation. Dividing the amplitude of the fourth response by the amplitude of the first response provides the TOF ratio (T_4/T_1)

In the control response (the response obtained before administration of muscle relaxant), all four responses are ideally the same : the TOF ratio is 1.0.

During a partial non-depolarizing block, the ratio decreases ('fades') and is inversely proportional to the degree of blockade. During a partial depolarizing block, no fade occurs in the TOF response.

The advantage of TOF stimulation is that it obviates the need for a pre-relaxant baseline twitch height determination. TOF thus serves as its own control.

3. TETANIC STIMULATION (TS)

Tetanic stimulation is the mode in which the nerve is stimulated 50 times per second (50 Hz) or 100 times per second (100 Hz) for 5 seconds. It detects whether the response is sustained or fades during the stimulus.

During depolarizing block the peak tension is decreased but sustained. With non-depolarizing block and with phase II block peak height decreases and fades.

Tetanic stimulation is very painful and should be applied only to anaesthetized patients

4. POST-TETANIC COUNT (PTC)

It is possible to quantify intense neuromuscular blockade of the peripheral muscles by applying tetanic stimulation (50 Hz for 5 sec) and

observing the post-tetanic response to single twitch stimulation given at 1 Hz starting 3 seconds after the end of tetanic stimulation. During very intense blockade, there is no response to either tetanic or post-tetanic stimulation.

The main application of the PTC method is in evaluating the degree of neuromuscular blockade when there is no reaction to single-twitch or TOF nerve stimulation.

5. DOUBLE BURST STIMULATION (DBS)

This mode of stimulation is a refinement of the TOF, particularly for tactile or visual evaluation of full recovery of muscle strength.

DBS consists of two short bursts of 50 Hz tetanic stimulation separated by 750 msec. In the DBS_{3,3} mode, 3 stimuli are given twice. In the DBS_{3,2} mode, 3 and 2 stimuli are given in each burst.

When a non-depolarizing muscle relaxant is given, fading takes place between these two bursts. Interpretation is based on comparison of the two responses produced by this type of stimulation.

Sites of nerve stimulation and different muscle responses

In principle any motor nerve innervating muscles with a clearly visible motor response lends itself to neuromuscular monitoring. The following nerves may be used as they are superficial:

1. the ulnar nerve,
2. the median nerve,
3. the posterior tibial nerve,
4. the common peroneal nerve and
5. the facial nerve

In clinical anaesthesia, the ulnar nerve is the most popular site. For stimulation of the ulnar nerve, the electrodes are best applied at the volar side of the wrist. The distal electrode should be placed about 1 cm proximal to the point at which the proximal flexion crease of the wrist crosses the radial side of the tendon to the flexor carpi ulnaris muscle. The proximal electrode should be placed 2 to 5 cm proximal to the distal electrode. With this placement of the electrodes, electrical stimulation normally elicits only finger flexion and thumb adduction.

Recording of evoked responses

Three methods are available:

1. Mechanomyography: Measurement of evoked mechanical responses.
2. Electromyography (EMG): Measurement of evoked electrical responses.
3. Acceleromyography : Measurement of acceleration of the muscle response.

5. REVIEW OF LITERATURE

A rapid predictable onset of neuromuscular blockade is a prerequisite for smooth tracheal intubation. Succinylcholine is the standard neuromuscular blocking agent for this purpose. However, it has several side effects, some of which are inconvenient while others may be harmful.

Literature was reviewed to compare intubating conditions, onset of action and adverse effects of Rocuronium bromide and Succinylcholine.

1. **Wierda J.M.K.H., et al (1990)²⁴** showed that a dose of 0.5 mg/kg of Rocuronium produced 75% blockade in 68 seconds, complete blockade in 200 seconds and recovery to 25% of T_1 in 34 minutes.
2. **Meistelman C., et al (1994)¹⁶** found that onset time, intensity of blockade and duration of action were less at the larynx than at the

adductor pollicis with 0.5 mg/kg of Rocuronium. The onset times were 1.4 ± 0.1 and 2.4 ± 0.2 minutes at the laryngeal muscles and adductor pollicis, respectively. Maximum blockade was $77 \pm 5\%$ and $98 \pm 1\%$ respectively ($p=0.01$) and time to 90% T_1 recovery was 22 minutes.

3. **Jean Paul Cantinneau, *et al* (1994)¹¹** found that the diaphragm is more resistant than the adductor pollicis to Rocuronium 0.6 mg/kg. The onset time for muscle relaxation after 0.6 mg/kg Rocuronium was shorter for the adductor pollicis muscle than for the diaphragm (80 ± 20 vs 120 ± 62 sec). Times for 10%, 25%, 75% and 90% recovery of twitch height were 34 ± 10 , 40 ± 13 , 56 ± 20 and 64 ± 21 minutes, respectively for the adductor pollicis, and significantly shorter for the diaphragm, 17 ± 10 , 23 ± 9 , 33 ± 13 and 35 ± 10 minutes, respectively. The intubating dose of 0.6 mg/kg is close to the ED_{95} of 0.5 mg/kg for the diaphragm.
4. **Peter M.C. Wright, *et al* (1994)²⁰** studied the onset and duration of Rocuronium and Succinylcholine at the adductor pollicis and laryngeal adductor muscles in anaesthetized adults. They found that the onset of effect with Succinylcholine was significantly more rapid at the laryngeal adductors (34 ± 12 sec) than at the adductor pollicis

(56 ± 15 sec). Onset times were similar at the two muscle groups with Rocuronium 0.8 and 1.2 mg/kg (96 ± 29 and 74 ± 36 sec with 0.8 mg/kg and 54 ± 30 and 65 ± 21 sec with 1.2 mg/kg at the laryngeal adductors and the adductor pollicis, respectively). Rocuronium 0.4 mg/kg had a more rapid effect at the laryngeal adductors than the adductor pollicis (92 ± 29 sec and 155 ± 40 sec, respectively).

They concluded that the laryngeal adductors are more resistant to the action of Rocuronium than is the adductor pollicis. Onset of effect of Rocuronium in doses greater than 0.8 mg/kg is similar to that of Succinylcholine at the adductor pollicis but is significantly delayed compared with that of Succinylcholine at the laryngeal adductors.

5. **De Mey J.C., *et al* (1994)**⁷ evaluated onset and intubation conditions of Rocuronium bromide 0.6, 0.75 or 0.9 mg/kg in adult patients anaesthetized with propofol 2mg/kg and alfentanil 0.5 to 1 μ g/kg. They concluded that a dose of Rocuronium equal to or larger than 0.6 mg/kg provides acceptable intubation conditions at 60 seconds after administration. Onset times were 271 ± 129 , 189 ± 119 and 135 ± 79 seconds following Rocuronium 0.6, 0.75 and 0.9 mg/kg, respectively. Time taken for recovery of T_1 to 25% of

control was 27.3 ± 8.2 , 43.6 ± 12.0 and 53.0 ± 15.2 minutes in the 3 groups respectively.

6. **Mirakhur R.K., et al (1994)**¹⁷ compared onset and intubating conditions of Rocuronium bromide 0.6 mg/kg and Succinylcholine 1 mg/kg in adult patients anaesthetized with Thiopentone, Nitrous oxide in Oxygen and small doses of Fentanyl. Intubating conditions after Rocuronium 0.6 mg/kg were found to be clinically acceptable (good or excellent) in 95% of patients at 60 seconds and in all patients at 90 seconds and in all patients at both times after succinylcholine. There were no significant difference in acceptable intubating conditions between succinylcholine and Rocuronium.

The average time for the onset of block following Rocuronium at this dose was 89 seconds and duration of clinical relaxation 30 minutes. For succinylcholine, the corresponding values were 60.4 seconds and 13 minutes, respectively. The degree of neuromuscular block with Rocuronium was 89% at 60 seconds and 98% at 90 seconds.

7. **Previs TH, Zahn P., et al (1994)** Studied the ED₉₅ dose of Rocuronium bromide and the tracheal intubating conditions and time course of actions. They concluded that ED₉₅ dose of

Rocuronium bromide was 0.3 mg/kg and duration of action was 20 minutes.

8. **Wierda J.M.K.H., *et al* (1995)²⁵** compared the time course of action and intubating conditions following vecuronium, Rocuronium and Mivacurium in adults anaesthetized with Thiopentone (4 to 6 mg/kg) and Fentanyl (1 to 3 µg/kg). Intubating conditions after 2 x ED₉₀ dose of Rocuronium at 90 seconds were significantly better than those after Vecuronium and Mivacurium. The average onset times of Rocuronium (172 sec) and Vecuronium (192 sec) were significantly shorter than that of Atracurium (229 sec). The clinical duration was significantly shorter after Mivacurium (13 min) than with Vecuronium (33 min) and Rocuronium (28 min).

They concluded that Rocuronium might be of advantage whenever the interval between administration of muscle relaxant and tracheal intubation must be short.

9. **Scheiber G., *et al* (1996)²¹** Compared 0.6 mg/kg Rocuronium, 0.1 mg/kg Vecuronium and 0.5mg/kg Atracurium in children during Etomidate-Fentanyl-Nitrous oxide anaesthesia and found better intubating conditions at 60 seconds after Rocuronium than 120

seconds after Vecuronium or at 80 seconds after Atracurium administration.

10. **K.Barclay., et al (1997)³** assessed whether low doses of Rocuronium improved conditions for tracheal intubation during induction of anaesthesia with Propofol 2.5mg/kg and Alfentanil 10ug/kg. They have studied three groups. One group received saline, second group Rocuronium 0.1 mg/kg and the third group received 0.3 mg/kg Rocuronium and they assessed in intubating conditions as judged by jaw opening and laryngoscopy, position of the vocal cords and degree of straining after tracheal intubation. They concluded that injection of Rocuronium 0.3 mg/kg with Propofol and Alfentanil provided a high proportion of optimal intubating conditions.
11. **Fuchs- Buder T., et al (1997)⁸** showed that in children, Rocuronium 0.6mg/kg and 0.9mg/kg with Thiopentone 5mg/kg and Alfentanil 10µg/kg offered good to excellent intubating conditions for elective rapid sequence induction at 60 seconds. Onset times were 193 ± 43 and 118 ± 23 seconds respectively.
12. **Weiss JH., et al (1997)²³** Studied the intubating conditions in adult patients for elective surgery with Rocuronium 0.7mg/kg,

Rocuronium 0.9 mg/kg and Succinylcholine 1.5 mg/kg, anaesthetized with Fentanyl 2µg/kg and Thiopentone 4-5mg/kg. Rocuronium 0.7mg/kg displayed a significant lower score <60% and rated as poor. Rocuronium 0.9 mg/kg provides similar intubating conditions to Succinylcholine 1.5mg/kg at 60 seconds

13. **Smith I, Saad Rs., et al (1998)²²** Compared the onset of action and the intubating conditions after Rocuronium 0.6 mg/kg and Rocuronium 0.1mg/kg, when the timing of tracheal intubation was determined by clinical judgment alone like ease of ventilation, jaw and upper airway tone. They concluded that time to laryngoscopy and completion of intubation was markedly shorter in the Rocuronium group. Rocuronium group also had significantly better intubating conditions.
14. **McCourt K.C., et al (1998)¹⁵** compared tracheal intubating conditions at one minute during rapid-sequence induction of anaesthesia using Rocuronium 0.6mg/kg, Rocuronium 1.0 mg/kg or Succinylcholine 1 mg/kg in adult patients, anaesthetized with Fentanyl and Thiopentone. Their results showed that intubating conditions were significantly superior with 1.0 mg/kg than 0.6 mg/kg of Rocuronium. Final comparison between 1.0 mg/kg of

Rocuronium and 1 mg/kg of Succinylcholine showed no significant difference in the incidence of acceptable intubations (96 and 97% respectively). The incidence of excellent grade of intubations was however, significantly higher with Succinylcholine (80% vs 60%, $p=0.02$).

They concluded that Rocuronium 1 mg/kg can be used as an alternative to Succinylcholine 1mg/kg as part of rapid-sequence induction provided there is no anticipated difficulty in intubation. The clinical duration of this dose of Rocuronium was 50 to 60 minutes.

15. **Kirkegaard-Nielson, H. *et al.*, (1999)¹²** studied rapid tracheal intubation with Rocuronium using a probability based approach. 80 adult patients anaesthetized with Fentanyl 2 µg/kg and Propofol 2 mg/kg randomly received Rocuronium 0.0, 0.4, 0.8 or 1.2 mg/kg ($n=20/\text{dose}$). Laryngoscopy was initiated at 40 seconds aiming for intubation at 60 seconds. Doses giving 90 and 95% (D_{90} and D_{95}) probability of successful intubation were calculated and found to be 0.83 (0.59 – 1.03) and 1.04 (0.76 – 1.36) mg/kg respectively. Estimated times until first tactile train-of-four response after D_{90} and D_{95} doses were 32 and 46 minutes respectively.

They concluded that after induction with Fentanyl and Propofol, Rocuronium 1.04 mg/kg gives 95% probability of successful intubation at 60 seconds.

16. **Hans P., et al (1999)**⁹ found that Ketamine 2.5 mg/kg provides better intubating conditions (excellent and good) than Thiopentone 5 mg/kg, one minute after Rocuronium 0.6 mg/kg in adult patients, 100% and 50% respectively. The degree of neuromuscular blockade (% decrease of T_1) at the time of intubation was similar, $51.8 \pm 25\%$ (Ketamine group) and $54.3 \pm 23\%$ (Thiopentone group).
17. **Andrews JI., et al (1999)**¹ Compared Rocuronium and Succinylcholine for rapid sequence induction of anaesthesia along with Propofol and anaesthesia was induced using Propofol 2.5mg/kg followed immediately by either Rocuronium 0.6 mg/kg or 1 mg/kg or Succinylcholine 1mg/kg. Intubating conditions were assessed at one minute and intubation was performed. They concluded Rocuronium 1mg/kg given along with Propofol in a rapid sequence induction of anaesthesia is clinically equivalent to Succinylcholine 1mg/kg.
18. **A.P. Dobson., et al (1999)**² Compared intubating conditions with Thiopentone and Propofol for rapid sequence induction of

anaesthesia using 0.6 mg/kg of Rocuronium at 30, 40, 50, 60 and 70 seconds and they concluded that satisfactory intubating conditions are achieved approximately 60 seconds after induction of anaesthesia with Propofol than with Thiopentone.

19. **Lam AM., *et al* (2000)¹³** compared the onset and offset time and intubating condition after 1 min obtained with Rocuronium bromide 0.6mg/kg and Succinylcholine 1mg/kg after induction with Propofol and Fentanyl. They concluded that Rocuronium 0.6mg/kg, when used with Propofol and Fentanyl for induction, provides intubating conditions similar to Succinylcholine 1mg/kg at 1 minute.
20. **Cheng CAY., *et al* (2002)⁵** compared intubating conditions of Succinylcholine 1.5mg/kg and Rocuronium 0.6mg/kg and Rocuronium 0.9 mg/kg in children induced with Alfentanil 10µg/kg and Thiopentone 5-6mg/kg. Intubating conditions were excellent in 92% with Succinylcholine 1.5mg/kg, 95% with Rocuronium 0.9 mg/kg and 72.5% with Rocuronium 0.6mg/kg.

The author concluded that Rocuronium 0.9 mg/kg provides similar intubating conditions to Succinylcholine 1.5mg/kg at 60 seconds

21. **Bhatia Pradeep kumar *et al* (2004)⁴** compared the intubating condition, onset time and duration of Succinylcholine 1.5mg/kg and Rocuronium 0.6mg/kg in adults patients were premedicated with Injection pentazocine 30mg and atropine 0.6mg/kg 30 minutes before surgery. The neuromuscular blockade measured by twitch height in response to ulnar nerve stimulation. He concluded that the onset of action was 87.94 seconds and 65.89 seconds with Rocuronium 0.6mg/kg and Succinylcholine 1.5mg/kg respectively. He concluded there that is no significant difference in intubating condition between both groups with mean intubation score of 7.37 and 7.79 with Rocuronium 0.6mg/kg and Succinylcholine 1.5mg/kg respectively.
22. **R.K.Verma *.,et al* (2007)¹⁹** compared the effect on intubating condition, onset time, clinical duration and cardiovascular effects of Succinylcholine 1mg/kg and Rocuronium 0.6mg/kg and 0.9 mg/kg in adults elective surgical procedures after induction with Thiopentone 4-6mg/kg.

The study revealed a significant difference in time between the three groups. Fastest with Succinylcholine 1mg/kg (52.8 ± 15) seconds, followed by Rocuronium 0.9mg/kg (102 ± 40) seconds and Rocuronium 0.6mg/kg (163 ± 58) seconds. Intubating conditions

were good to excellent with 92% in Succinylcholine 1.5mg/kg ,100% in Rocuronium 0.9mg/kg and 88%in Rocuronium 0.6mg/kg.The author concluded that Rocuronium 0.9 mg/kg provide similar intubating conditions to Succinylcholine 1mg/kg .

6. MATERIALS AND METHODS

This study was conducted at Government Stanley Hospital, Chennai, in the patients undergoing general surgical procedures.

After institutional approval and informed consent, 60 patients were enrolled in the study.

INCLUSION CRITERIA:

All ASA Physical status 1 and 2 patients aged between 20-60 years scheduled for elective surgery under general anaesthesia.

EXCLUSION CRITERIA

- Modified Mallampatti Airway Classification III, IV
- Morbidly Obese,
- Pregnant women,
- Neuromuscular disease,

- Hepatic or renal disease,
- Patients receiving any medication known to interact with neuromuscular blocking agents.

PREOPERATIVE EVALUATION

In all the patients age, body weight, preoperative blood pressure and pulse rate were recorded. History regarding previous anaesthesia and surgery, any significant medical illness, medications and allergy were recorded.

A complete physical examination and airway assessment was done.

Laboratory investigations.

Hemoglobin%

Packed cell volume

Urine- Albumin, Sugar

Blood sugar

Blood Urea

Serum creatinine

Serum electrolytes

Electrocardiogram

Chest X-Ray

On arrival in the operating room intravenous access was secured with 18G cannula in a vein in dorsum of hand. Ringer lactate infusion started. Following monitors are connected.

Pulseoximeter

Electrocardiogram and

Non invasive blood pressure monitor

Basal recording were noted

PREMEDICATION

Inj. Midazolam 0.01mg intravenously	} 15 min before surgery.
Inj. Pentazocine 0.5mg/kg intravenously	

The patients were systematically randomized in to three groups of twenty each.

Group A	:	Succinylcholine 1.5 mg/kg (Sch 1.5)
Group B	:	Rocuronium bromide 0.6 mg/kg (2 x ED 95) (Roc 0.6)
Group C	:	Rocuronium bromide 0.9 mg/kg (3 x ED 95) (Roc 0.9)

After preoxygenation for 3 minutes anaesthesia was induced with Thiopentone sodium 5mg/kg over a period of 20 seconds.

Respiration was assisted with 100% oxygen following loss of consciousness, the ulnar nerve was stimulated at the wrist using 0.1 Hz single twitch stimulation mode and the supramaximal current was determined.

Once a control twitch height was established the bolus of randomly assigned neuromuscular blocking agent was administered intravenously in less than 5 seconds. When injection was completed, a timer was started and after 20 seconds the ulnar nerve was stimulated using single twitch mode at a frequency of 1 Hz.

At one minute, intubation was performed and scored by a blinded experienced anaesthesiologist.

After intubation and observation of onset time, anaesthesia was maintained as appropriate for surgical needs with Nitrous oxide, oxygen and Neuromuscular blocking agents.

The following observations were recorded:

1. Intubating Conditions:

Intubation conditions were scored at one minute by a scoring system used by Mirakhur R.K., cooper A.R. and Clarke R.S.J. (Table II and Table III)

Table II

SCORING OF INTUBATING CONDITIONS

Score	0	1	2	3
Jaw relaxation	Poor	Minimal	Moderate	Good
Vocal cord position	Closed	Closing	Moving	Open
Response to intubation	Severe coughing or bucking	Mild coughing	Light diaphragmatic movement	None

Table III

TOTAL SCORE

Intubating Conditon	Score
Excellent	8-9
Good	6-7
Poor	3-5
Bad	0-2

2. Onset of action

The time taken for 100% suppression of single twitch was noted.

3. Adverse effects

Patients were monitored for signs of histamine release such as wheal, flushing, bronchospasm, tachycardia and hypotension analysis.

The data was computed and all values expressed as mean \pm SD. The data was analyzed using CHI-SQUARE test, ANOVA F-test, P value < 0.05 is significant.

7. OBSERVATION AND RESULTS

The study was conducted on 60 adults randomly allotted into 3 groups as given below.

Table IV

DRUG AND DOSAGE SCHEDULE

Group	Drug	Dosage	Sample size	Abbreviation
A	Succinylcholine	1.5 mg/kg	20	Sch 1.5
B	Rocuronium	0.6 mg/kg	20	Roc 0.6
C	Rocuronium	0.9 mg/kg	20	Roc 0.9

DEMOGRAPHIC PROFILE

Age, sex and weight are compared between three groups.

Table V

AGE DISTRIBUTION

Group	N	Mean Age	Std. Deviation	ANOVA F-test
Group A(Sch 1.5)	20	38.30	11.712	F=0.40 P=0.67 Not significant
Group B (Roc 0.6)	20	35.20	9.833	
Group C (Roc 0.9)	20	36.85	11.264	
Total	60	36.78	10.854	

P Value – 0.67 – Not Significant

AGE DISTRIBUTION

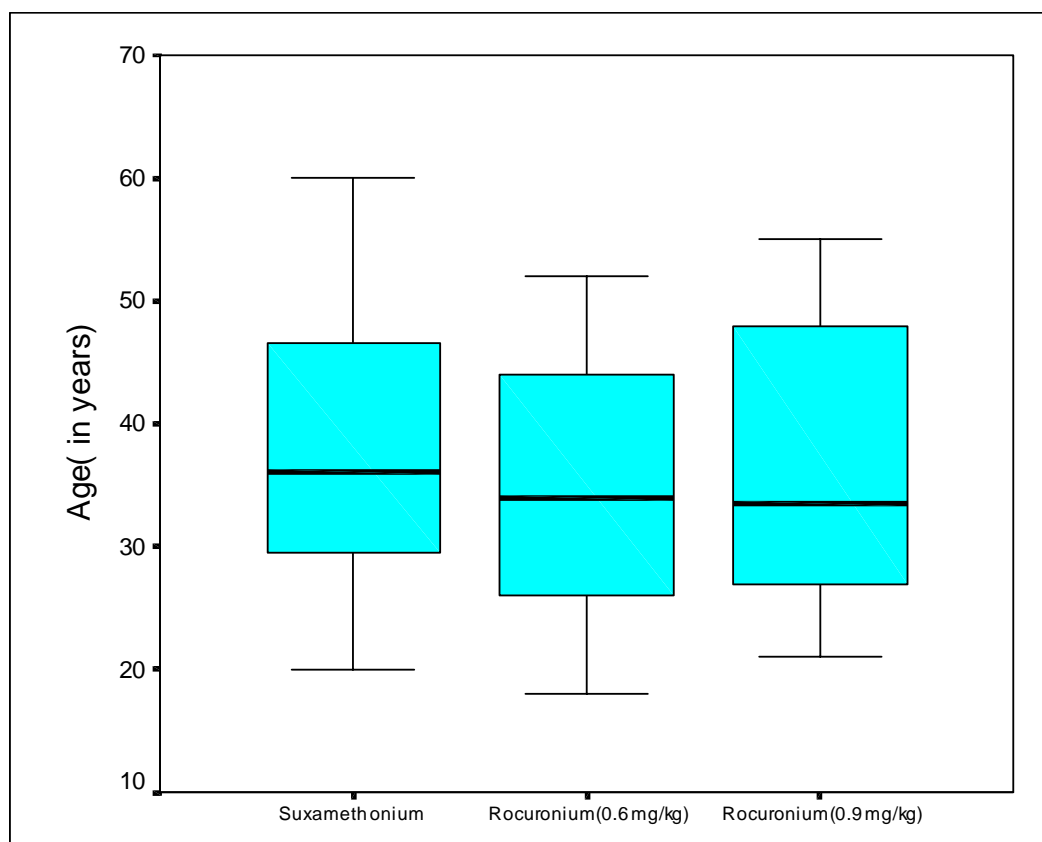


Table VI
SEX DISTRIBUTION

Group	Sex		Total
	Male	Female	
Group A(Sch 1.5)	8	12	20
Group B (Roc 0.6)	11	9	20
Group C (Roc 0.9)	10	10	20
Total	29	31	60

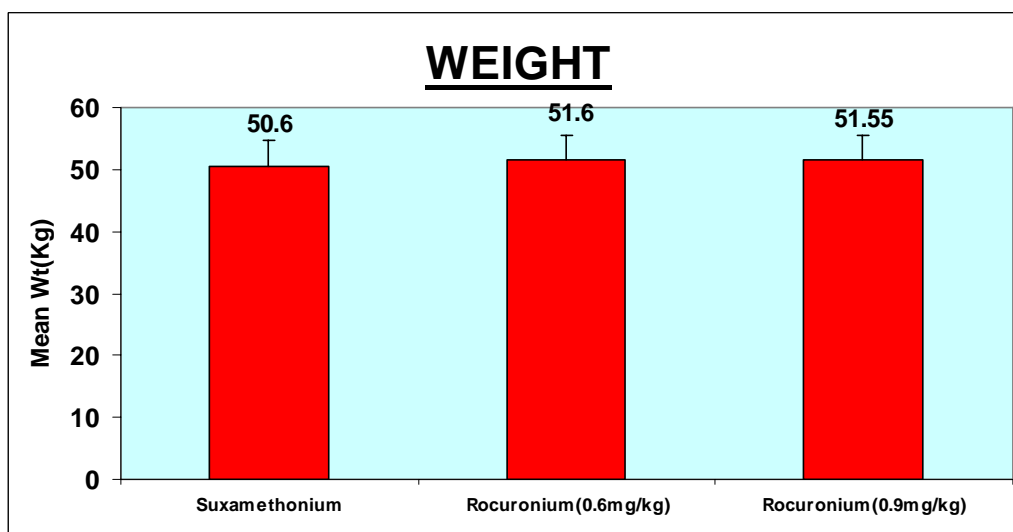
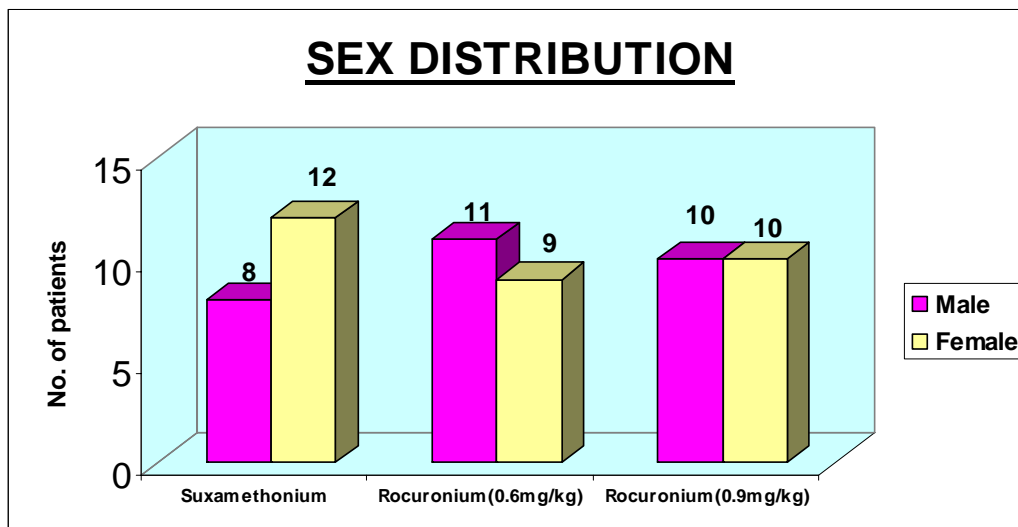
$\chi^2=0.93$ P=0.63 Not Significant

Table VII
WEIGHT DISTRIBUTION

Group	N	Mean	Std. Deviation	ANOVA F-test
Group A(Sch 1.5)	20	50.60	6.946	F=0.16 P=0.86 Not significant
Group B (Roc 0.6)	20	51.60	5.548	
Group C (Roc 0.9)	20	51.55	6.395	
Total	60	51.25	6.232	

P value – 0.86 - Not Significant

The age, body weight and sex distribution are not significantly different.



1. TRACHEAL INTUBATING CONDITIONS AT 1 MINUTE.

The scores for jaw relaxation, vocal cord position and response to intubation and the total scores and compared between three groups at 1 minute.

Table VIII

JAW RELAXATION

Group	Sample Size	Jaw relaxation Score 3 (Good)	Total
Group A (Sch 1.5)	20	20	20
Group B (Roc 0.6)	20	20	20
Group C (Roc 0.9)	20	20	20

Table IX

VOCAL CORD POSITION

Group	Sample size	Vocal Cords Score		Total
		2 (Moving)	3 (Open)	
Group A (Sch 1.5)	20	3	17	20
Group B (Roc 0.6)	20	12	8	20
Group C (Roc 0.9)	20	1	19	20

$\chi^2=20.8$ $P=0.001$ significant

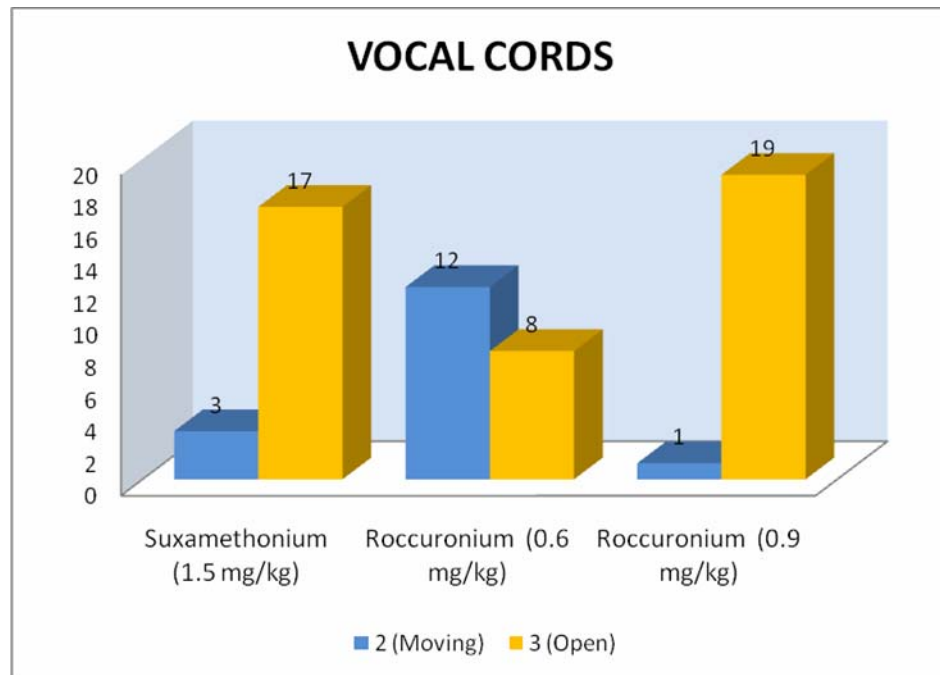


Table X
RESPONSE TO INTUBATION

Group	Sample size	Response to Intubation Score			Total
		1	2	3	
Group A(Sch 1.5)	20	0	0	20	20
Group B (Roc 0.6)	20	11	6	3	20
Group C (Roc 0.9)	20	0	3	17	20

0 – severe cough / bucking

1 – Mild cough

2 – light diaphragmatic movement

3 – none

$\chi^2=40.3$ P=0.001 significant

Table XI
Number of patients exhibiting the different intubation score

Group	Total intubation score								
	Excellent		Good		Fair			Poor	
	9	8	7	6	5	4	3	2	1 0
Sch 1.5	18	2	0	0	0	0	0	0	0 0
Roc 0.6	3	3	7	7	0	0	0	0	0 0
Roc 0.9	17	2	1	0	0	0	0	0	0 0

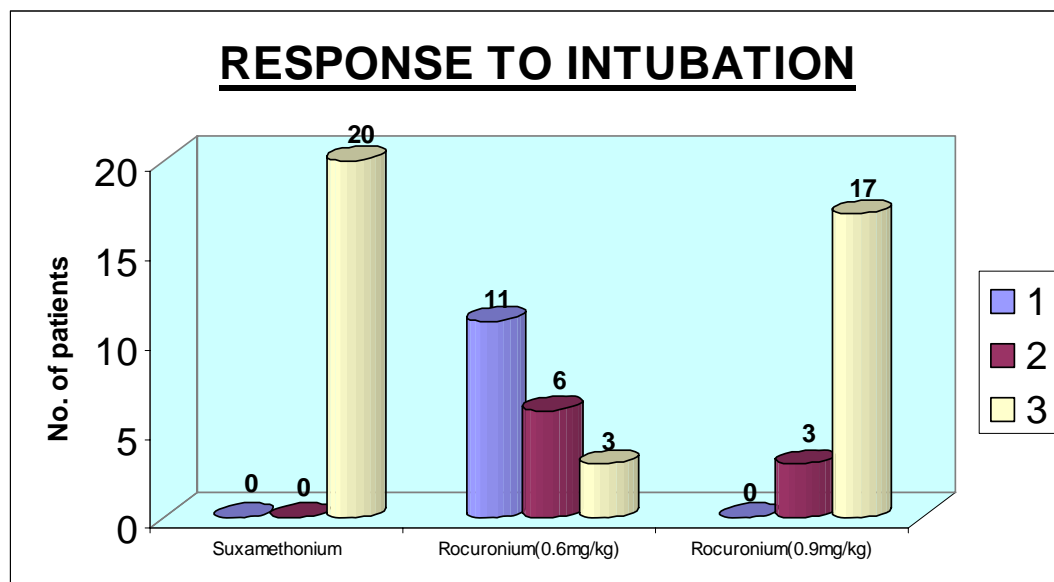
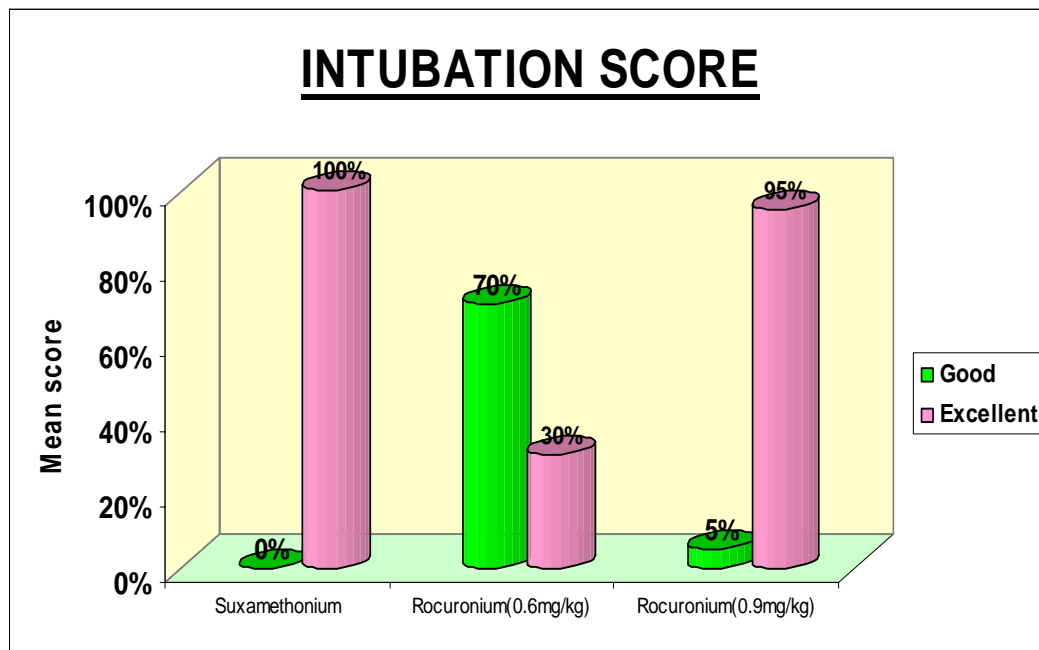


Table XII
INTUBATION SCORE

Group	Sample size	Intubation score		Total
		Good	Excellent	
Group A(Sch 1.5)	20	0	20 (100%)	20
Group B (Roc 0.6)	20	14 (70%)	6 (30%)	20
Group C (Roc 0.9)	20	1 (5%)	19 (95%)	20

$\chi^2=32.53$ P=0.001 significant

Excellent intubating conditions was seen with Group A (Sch 1.5mg/kg) with 100% score. Excellent intubating conditions with Group B (Roc 0.6 mg/kg) and Group C are 30% and 85% respectively. P value of Succinylcholine 1.5 mg/kg and Rocuronium 0.9 mg/kg is 0.466 statistically not significant.



2. TIME OF ONSET

(Mean time for 100% suppression of twitch height)

Table XIII

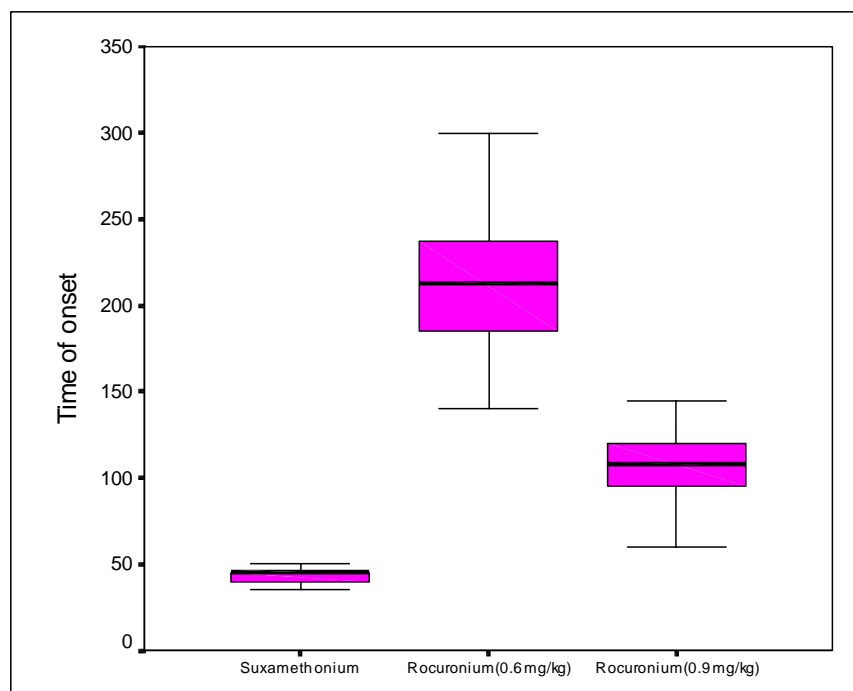
Group	Sample size	Mean	Std. Deviation	Anova F - test
Group A (Sch 1.5)	20	43.75	3.582	F = 150.93 P = 0.001 Significant
Group B (Roc 0.6)	20	220.75	51.638	
Group C (Roc 0.9)	20	105.55	22.993	

In group A (Sch 1.5 mg/kg) onset of action was 43.75 ± 3.582 seconds significantly faster than either group B (Roc 0.6mg/kg) and group C (Roc .9mg/kg), 220.75 ± 51.638 seconds vs 105.55 ± 22.993 seconds. The difference in onset of action between the three groups are statistically significant.

3. EVALUATION OF ADVERSE EFFECT

No signs of histamine release such as wheal, flushing, bronchospasm, tachycardia or hypotension were not seen in any of the three groups

TIME OF ONSET



8. DISCUSSION

There has been a trend in recent years to focus on the ability of neuromuscular blocking agents to facilitate tracheal intubation, rather than the traditional measure of onset, potency and duration.

Intubation studies are difficult to perform and interpret because the details of anaesthesia management, patient age, and anatomy, equipment and experience of the endoscopist all affect the ease of intubation.

There is no accepted standardization of the background anaesthesia and time to laryngoscopy. The evaluation of intubating condition although blinded remains subjective.

In our study, intubating conditions at one minute, onset of action and adverse effects were studied following administration of Succinylcholine 1.5mg/kg IV, Rocuronium 0.6 and 0.9 mg/kg IV in adults anaesthetized with Thiopentone sodium 5mg/kg IV.

All the three groups were similar with regards to age, sex and weight.

Succinylcholine, a depolarizing muscle relaxant with its rapid onset and shorter duration of action is still the relaxant of choice to facilitate rapid tracheal intubation. Succinylcholine has got many side effects such as rise in serum potassium, bradycardia etc. Because most of the side effects of Succinylcholine is due to its depolarizing mechanism of action, search for ideal neuromuscular blocking agent is being focused on non depolarizing type of relaxants which has rapid onset and offers good to excellent intubating conditions.

Rocuronium, a nondepolarizing amino steroidal muscle relaxant a low potency compound offers early onset of action and excellent to good intubating conditions.

The dosage of Succinylcholine was selected as per text book description and studies done by **weiss²³ et al** and **Bhatia Pradeep kumar⁴ et al**. They concluded that Succinylcholine 1.5 mg /kg IV provides ideal intubating conditions and quicker onset of actions.

Studies of **Bhatia pradeep kumar⁴ et al**, **Mirakhur.K¹⁷ et al** and **Cooper⁶ et al** have shown shorter onset time and intubating conditions at 60 seconds are excellent to good with a dose of 0.6 mg/kg IV of Rocuronium.

R.K.Verma¹⁹ *et al*, Cheng CAY⁵ *et al* and **weiss²³ *et al*** compared two doses of Rocuronium at 60 seconds and concluded that 0.9 mg/kg provides similar intubating conditions to Succinylcholine and 0.6 mg/kg did not provide adequate intubating conditions

All ASA class I and class II patients aged between 20 - 60 years scheduled for elective general surgical procedures under general anaesthesia were selected for study .

On arrival to operating, room intravenous access secured and monitors connected. Injection Midazolam 0.01 mg/kg and Injection Pentazocin 0.5 mg/kg Intravenously given 15minutes before surgery and then patients were systematically randomized in to 3 groups of 20 each

Group A : Succinylcholine 1.5 mg/kg (Sch 1.5)

Group B : Rocuronium bromide 0.6 mg/kg(Roc 0.6)

Group C : Rocuronium bromide 0.9 mg/kg (Roc 0.9)

All patients were preoxygenated with 100% oxygen for 3 minutes and induced with Thiopentone sodium 5mg/kg, respiration was assisted with 100% oxygen, following loss of consciousness the ulnar nerve was stimulated and supramaximal current was determined

Once a control twitch was established the bolus of randomly assigned neuromuscular blocking agent was administered in less than 5 seconds .The ulnar nerve was stimulated every 20 seconds using single twitch mode at frequency of 1 HZ.

At 1 minute intubation was performed and scored by experienced anaesthesiologist. The following observations were recorded, Jaw relaxation, Vocal cords and response to intubation were recorded and scored by system as shown by **Mirakhur R.K, Cooper A.R . and Clarke R.S.G *et al***

The time taken for 100% suppression of single twitch was concluded as onset of action.

After intubation and observation anaesthesia was maintained as appropriate for surgical needs with Nitrous oxide , Oxygen and neuromuscular blocking agent

In our study all three groups showed good Jaw relaxation , 3 patients in Succinylcholine 1.5 mg/kg group showed moving vocal cords and 12 patients in Rocuronium 0.6 mg/kg and 1 patient in Rocuronium 0.9 mg/kg group . Regarding response to intubation 11 patients in Rocuronium 0.6 mg/kg group, showed mild coughing, 6 patients – light

diaphragmatic movement, and 3 patients showed no response . In Rocuronium 0.9 mg/kg group ,3 patients showed light – light diaphragmatic movement, and 17 patients showed no response .In Succinylcholine 1.5 mg/kg group, no patient showed any response to intubation.

In our study excellent intubating condition was significantly higher with Succinylcholine 1.5 mg/kg (100%) compared with either dose of Rocuronium. Rocuronium 0.9 mg/kg (95%) had a significantly higher incidence of excellent intubating condition than Rocuronium 0.6 mg/kg (30%). There is no significant statistical difference between Rocuronium 0.9 mg/kg and Succinylcholine 1.5 mg/kg.

This is comparable to study of **R.K.Verma¹⁹ *et al*, Cheng CAY⁵ *et al* and weiss²³ *et al*. Mirakhur R.K¹⁷, Cooper A.R⁶ *et al*** showed 95 % at 60 seconds and all patients in 90 seconds.

In our study mean onset time were (43.75 ± 3.6) seconds with Succinylcholine 1.5 mg/kg and (105.6 ± 23) seconds with Rocuronium 0.9 mg/kg and (220 ± 52) seconds with Rocuronium 0.6 mg/kg. Significant Statistical difference exist between all the three groups. Succinylcholine had a quicker onset than either dose of Rocuronium.

This is similar to study of **R.K.Verma¹⁹ *et al*** showing onset time of 52.8 seconds with Succinylcholine 1.0 mg/kg and 102.6 seconds with Rocuronium 0.9 mg/kg and 163 seconds Rocuronium 0.6 mg/kg

Bhatia Pradeep kumar⁴ *et al* showed the onset of Succinylcholine 1.5 mg/kg as 65.89 seconds and 87.94 seconds with Rocuronium 0.6 mg/kg. **Fuchs-Buder⁸ *et al*** showed 193 seconds with Rocuronium 0.6 mg/kg and 118 seconds with Rocuronium 0.9 mg/kg **Wierda²⁴ *et al*** showed mean onset time of 172 seconds with Rocuronium 0.6 mg/kg .

No evidence of histamine release was observed in any of the patients in the three groups in our study.

9. SUMMARY

- Succinylcholine 1.5mg/kg IV gave a significantly higher incidence of excellent intubating conditions than either 0.6 mg or 0.9 mg/kg Rocuronium IV (100% vs 30% vs 85%) respectively.
- Rocuronium 0.9 mg/kg IV produced intubating condition similar to Succinylcholine 1.5mg/kg
- Rocuronium 0.6 mg/kg IV did not produced adequate intubating condition
- Succinylcholine 1.5mg/kg IV had a quicker onset (43.75 ± 3.582) sec than either dose of Rocuronium 0.9mg/kg (105.5 ± 22) and Rocuronium 0.6mg/kg (220.75 ± 51) seconds.
- No evidence of histamine release was observed in any of the patients in three groups.
- The cost factor is high with Rocuronium Compound to Succinylcholine.

10. CONCLUSION

- Succinylcholine is an ideal agent for intubation in all surgical procedures.
- Intubating conditions of Rocuronium bromide at a dose of 0.9mg/kg ($3 \times ED_{95}$) is comparable to Succinylcholine 1.5mg/kg at 1minute.
- Rocuronium bromide 0.9 mg/kg can be used safely in patients where Succinylcholine is contraindicated.

11. BIBLIOGRAPHY

1. Andrews JI, Kumar N, Van den Brom RH, Oikkola KT, Roest GJ, Wright PM

A large simple randomized trial of rocuronium versus succinylcholine in rapid sequence induction of anaesthesia along with propofol. *Acta Anaesthesiol Scand.* 1999 Jan; 43(1):1-8
2. A.P.Dobson, A.Mccluskey, G.Meakin and R.D.Baker

Effective time to satisfactory intubation conditions after administration of rocuronium in adults. Comparison of propofol and thiopentone for rapid sequence *Anaesthesia* 1999; **54** : 172-177
3. K.Barclay, K.Eggers and T.Asai

Low dose rocuronium improves condition for tracheal intubation after induction of anaesthesia with propofol and alfentanil. *British Journal of Anaesthesia* 199; **78** : 92-94
4. Bhatia Pradeep Kumar.Singh Ajeet, Tulsani Kishan Lal

Comparison of intubation conditions after administration of Rocuronium and suxamethonium.

Indian Journal of Anaesthesia 2004;**48(2)**: 129-133
5. Cheng CAY, Aun CST, Gin T.

Comparison of Rocuronium and suxamethonium for rapid tracheal intubation in children

Paediatric Journal of Anaesthesia 2002; **12**: 140 -145

6. Cooper R., Mirakhur R.K., Clarke R.S.J. and Boules Z.
Comparison of intubation conditions after administration of org 9426 (rocuronium) and suxamethonium.

British Journal of Anaesthesia 1992; **69**: 269-273.

7. De May J.C., Debrock M., Rolly G.
Evaluation of onset and intubation conditions of rocuronium bromide.

European Journal of anaesthesiology 1994; **11** (Suppl. 9) : 37-40

8. Fuchs – Buder T., Tassonyi E.
Intubating conditions and time course of rocuronium-induced neuromuscular block in children.

British Journal of Anaesthesia 1996; **77** : 335-338.

9. Hans P., Brichant J.F., Hubert B, Dewandre P.Y. and Lamy M.
Influence of induction of anaesthesia on intubating conditions one minute after rocuronium administration : comparison of ketamine and thiopentone. *Anaesthesia* 1991; **54** : 276-279
10. Hopkinson J.M., Meakin G., Mcluskey A. and Baker R.D.
Dose-response relationship and effective time to satisfactory intubation conditions after rocuronium in children.
Anaesthesia 1997; **52** : 428-432.
11. Jean Paul Cantineau, Frederick Porte, Gilles d'Honneur, Philippe Duvaldestin.
Neuromuscular effects of rocuronium on the diaphragm and adductor pollicis muscles in anaesthetized patients.
Anesthesiology 1994; **81** : 585-590.
12. Kirkegaard-Nielsen H., James E. Caldwell, Peter D. Berry
Rapid tracheal intubation with rocuronium.
Anesthesiology 1999; **91** : 131-136.

13. Lam AM, Pavlin EG, Visco E and Taraday J.
Rocuronium versus succinylcholine- atracurium for tracheal intubation and maintenance relaxation during propofol anaesthesia.
J Clin Anaesthesia 2000 Sep; 12(6):449-53
14. Magorian T., Flannery K.B., Miller R.D.
Comparison of rocuronium, succinylcholine and vecuronium for rapid-sequence induction of anaesthesia in adult patients.
Anaesthesiology 1993; **79** : 913-918.
15. McCourt K.C., Salmela L., Mirakhur R.K., Carrol M., Makinen M.T., Kansanaho M., Kerr C., Roest G.J. and Olkkola K.T.
Comparison of rocuronium and succinylcholine for use during rapid sequence induction of anaesthesia.
Anaesthesia 1998; **53** : 867-871
16. Meistelman C., Plaud B., Donati F.
A comparison of neuromuscular blocking effects of rocuronium bromide at the adductor pollicis and laryngeal muscles.
European Journal of Anaesthesiology 1994; 11 (Suppl.9) : 33-36
17. Mirakhur R.K. Cooper A.R. and Clarke R.S.J.

Onset and intubating conditions of rocuronium bromide compared to those of Succinylcholine.

European Journal of Anaesthesiology 1994; **11** (Suppl. 9) : 41-43.

18. Motsch J., Leuwer M., Pfau M., Zimmerman J. and Martin E.
Time course of action and recovery of rocuronium bromide in children during halothane anaesthesia – a preliminary report.
European Journal of Anaesthesia 1994; **11** : (Suppl.9) : 75-77.

19. R.K.Verma,R., Goordayal, S.Jaiswal,G.K.Sinha
A comparative study of Intubating conditions and cardiovascular Effects following Succinylcholine and Rocuronium in Adult Elective surgical patients.
The Internet Journal of anaesthesia 2007 ; **14**, No:1

20. Wright P.M.C; James E.Cardwell, Ronald D.Miller
Onset and duration of Rocuronium and succinylcholine at the adductor pollicis and laryngeal adductor muscles in anaesthetized humans. *Anaesthesiology* 1994;81:1110-1115.
21. Scheiber G., Ribeiro P.C., Marichal A.,
Intubating conditions and onset of action after rocuronium, vecuronium and atracurium in young children.
Anesth Analg 1996;83:320-324.
22. Smith I ,Saad.
Anaesthesia for infants and children
Sixth Edition (1996).
23. Weiss JH, Gratz I, Goldberg ME, Afshar, Insingha F, Larijani G,
Comparison of two doses of Rocuronium and Succinylcholine for rapid tracheal intubation.
J Clin Anaesthesia 1997;9 (5) : 379-382.

24. Wierda J.M..K.H., De Wit A.P.M., Kuizenga K, Agoston S.
Clinical observation on the neuromuscular blockading action of Org
9426, a new steroidal non-depolarising agent.
British Journal of Anaesthesia 1990;64:521-523.
25. Wierda J.M..K.H., Hommes F.D.M., Nap H.J.A. and van den Broek
L.
Time course of action and intubating conditions following
vecuronium, rocuronium and mivacurium.
Anaesthesia 1995;50:393-396.

PROFORMA

COMPARISON OF ONSET TIME AND INTUBATING CONDITIONS ACHIEVED WITH SUCCINYLCHOLINE 1.5mg/kg IV AND ROCURONIUM 0.6mg/kg & 0.9mg/kg IV

Name: _____ Study Group: _____

Age: _____ Sex: _____

I.P.No.: _____

Weight: _____

Unit: _____

PREOPERATIVE ASSESSMENT:

Airway: _____

General condition:

Investigations:

Pulse Rate: _____

Hb: _____

Blood Pressure: _____

Urine Albumin: _____

Sugar: _____

CVS: _____

Blood sugar: _____

RS: _____

Blood Urea : _____

ECG: _____

Serum Creatinine: _____

Chest X-ray: _____

Serum Electrolytes: _____

Fitness: _____

PREMEDICATION

Injection Midazolam 0.01mg intravenously
 } 15 minutes before
 Injection Pentazocine 0.5mg/kg intravenously surgery

INDUCTION OF ANAESTHESIA:

Preoxygenation With 100% oxygen for 3 -5 minutes

Induction Agent Thiopentone Sodium – 5mg/kg

Muscle Relaxant Suxamethonium – 1.5mg/kg (or) Rocuronium–
 0.6mg/kg (or) Rocuronium – 0.9mg/kg

Mask ventilation for 60 seconds

Intubation

INTUBATING CONDITIONS:

Score	Jaw relaxation	Vocal cord position	Response to intubation
0	Poor (Impossible)	Closed	Severe cough or bucking
1	Minimal (Difficult)	Closed	Mild coughing
2	Moderate (Fair)	Moving	Slight diaphragmatic movement
3	Good (Easy)	Open	None

SCORE:

Total score of intubation conditions

8-9 - Excellent

8-7 – Good

3-5 - Fair

0-2 - Poor

TIME OF ONSET OF ACTION:**ADVERSE EFFECTS:**

MASTER CHART

GROUP A : SUCCINYLCHOLINE 1.5mg/kg

	NAME	GROUP	AGE	SEX	Weight (Kgs)	Jaw relaxation	Vocal cords	Response to intubation	Intubation score	
	IANGARAJ	1	45	M	52	3	3	3	9	
	ALLIGA	1	45	F	50	3	3	3	9	
	NANDHI	1	20	F	42	3	2	3	9	
	AUSALYA	1	57	F	40	3	3	3	9	
	AMANIBAI	1	60	F	55	3	3	3	9	
	JMARAVEL	1	45	M	56	3	3	3	9	
	IULASI	1	29	F	45	3	2	3	8	
	ANI	1	34	F	50	3	3	3	9	
	ARTHASARATHY	1	30	M	60	3	3	3	9	
	JMATHY	1	28	F	40	3	3	3	9	
	NJALATCHI	1	50	F	42	3	3	3	9	
	IDHA	1	32	F	45	3	3	3	9	
	JBRAMANI	1	50	M	48	3	3	3	9	
	AMALA	1	48	F	52	3	3	3	9	
	JNASEKAR	1	45	M	50	3	3	3	9	
	MALRAJ	1	32	M	62	3	3	3	9	
	MASHANKAR	1	23	M	48	3	2	3	8	
	JKAR	1	21	M	55	3	3	3	9	
	ASANTHA	1	36	F	60	3	3	3	9	

GROUP B: ROCURONIUM 0.6mg/kg

NAME	GROUP	AGE	SEX	Weight (Kgs)	Jaw relaxation	Vocal cords	Response to intubation	Intubation score	
ANDRAN	2	26	M	52	3	2	1	6	
UVANESHWARI	2	32	F	45	3	2	1	6	
NDARI	2	33	F	43	3	3	2	8	
CHAI	2	43	M	50	3	2	1	6	
THI	2	25	F	50	3	2	2	7	
VARAJ	2	32	M	56	3	2	1	6	
RALAKSHMI	2	18	F	40	3	3	3	9	
PPUSAMY	2	45	M	52	3	3	1	7	
THONI	2	35	M	60	3	2	1	6	
JESH	2	25	M	58	3	3	1	7	
RMALA	2	24	F	50	3	2	2	7	
THIMA	2	50	F	48	3	3	1	7	
BILAN	2	32	M	58	3	2	1	7	
MANDHI	2	38	F	52	3	3	3	9	
ELAKANDAN	2	46	M	50	3	3	3	9	
NIEL RAJ	2	26	M	53	3	3	2	8	
AGAMI	2	50	F	55	3	2	2	7	
ERAN	2	36	M	62	3	2	1	6	
MODARAN	2	52	M	50	3	2	2	8	
BIKA	2	36	F	48	3	2	1	6	

GROUP C: ROCURONIUM 0.9mg/kg

	NAME	GROUP	AGE	SEX	Weight (Kgs)	Jaw relaxation	Vocal cords	Response to intubation	Intubation score	
	UTHIAH	3	50	M	55	3	3	3	9	
	APAMMAL	3	46	F	50	3	3	3	9	
	AMODARAN	3	55	M	58	3	3	3	9	
	HUVANESHWARI	3	32	F	56	3	2	2	7	
	AREEM	3	32	M	60	3	3	3	9	
	EPHEN	3	28	M	56	3	3	3	9	
	JIDEVI	3	34	F	52	3	3	3	9	
	JNDARI	3	33	F	43	3	3	2	8	
	IRANKHAN	3	26	M	55	3	3	3	9	
	UTHU	3	23	M	45	3	3	3	9	
	ALARVIZHI	3	36	F	45	3	3	3	9	
	NODHKUMAR	3	22	F	52	3	3	3	9	
	IAMARAI	3	43	M	40	3	3	3	9	
	AVEED AHMED	3	50	F	52	3	3	2	8	
	OHANA	3	33	F	62	3	3	3	9	
	AVANAMMAL	3	53	F	48	3	3	3	9	
	ARANRAJ	3	25	M	56	3	3	3	9	
	JKSHINABANU	3	21	F	42	3	3	3	9	
	ANAGAVALLI	3	52	F	46	3	3	3	9	
	JNIVASAN	3	43	M	58	3	3	3	9	